

Self-leveling elastic waterproofing coating

1. Summary

At present, green coatings only account for 8% of the architectural waterproofing coatings in China, is 1/5-1/6 in relative to that in United States and Germany. The amount of volatile organics (VOC) discharged per year is about 350,000 tons, which seriously pollute the environment, and 1.2 billions of solvent is wasted. Thus, it is imminent to develop and use novel type green architectural waterproofing material.

Green self-leveling elastic waterproofing coating is a new type waterproofing coating comprising chlorosulfonated polyethylene and modified rubber emulsion as base materials, fly-ash and cement as fillers, and a suitable amount of auxiliaries. This coating is characterized by non-toxic, no pollution, high strength, excellent elasticity, good waterproofing effect and self-leveling property. A uniform, continuous and flat coating film having a thickness above 2.0 mm can be formed by once working. The coating is suitable for working at a low temperature condition of about 0°C. The coating overcomes the shortcomings of common aqueous architectural waterproofing coatings with respect to poor effect in thick coating and not capable of being used at low temperature. A satisfactory effect has been acquired by applying this coating to architectural waterproofing construction in Qingdao, Beijing and etc.

2. Materials of the coating

2.1 Base materials

Chlorosulfonated polyethylene (CSM) emulsion and modified rubber emulsion (E) are used as base materials. CSM is characterized by excellent weather resistance, high elasticity, difficult-to-burn, water resistance, and resistance to acid, alkali, salt and chemicals. The modified rubber emulsion is characterized by good film-forming property, high elasticity, and good cold endurance, which can improve the film-forming, leveling and low temperature film-forming properties of coating. A self-leveling elastic waterproofing coating with high strength and high elasticity and capable of forming film at low temperature can be formulated by using chlorosulfonated polyethylene and

modified rubber emulsion as base materials together with the addition of suitable auxiliaries and fillers.

2.2 Auxiliaries

In order to meet the requirements of the coating film with regard to the technological properties of self-leveling and low temperature film-forming and to the physical-mechanical properties of high strength and high elasticity, some suitable types of auxiliaries at suitable amounts shall be added.

The addition of plasticizer and film-forming auxiliary to a polymer can reduce the action force among chains of the polymer, which, therefore, decreases the glass transition temperature T_g and the minimal film-forming temperature MFT, and increases the film-forming ability at room temperature and low temperature. Thus, plasticizer and film-forming auxiliary are used in an amount of 20-40% and 1-2%, respectively.

Cellulose derivative type thickening agent belongs to a non-structural thickening agent, which can increase the viscosity of the coating by increasing the viscosity of disperse phase, thereby achieving the object of improving the film-forming and leveling properties. The amount of the thickening agent is about 0.1%.

2.3 Fillers

Fillers have a certain influence on the properties of the coating including film-forming property, flowability, low temperature stability and strength. Fly-ash and quartz have low water absorption, and thus are superior to other fillers such as light calcium carbonate and talc with respect to the film-forming property and flowability of the coating formulated. However, quartz coating has poor low temperature stability, so fly-ash is selected as the filler. In addition, a suitable amount of cement is added for improving the strength of the coating. The common cement is preferred, and its amount shall not be too much; otherwise, the elasticity, plasticity and self-leveling property of the coating will be affected. By experiment, the filler-to-base material ratio is determined as 2.5-3.0:1.

3. Performances and features of the materials

3.1 Performances

The performance indexes and test results of the green self-leveling elastic

waterproofing coating are listed in Table 1.

Table 1 The performance indexes and test results of F-CS emulsion elastic waterproofing coating

Items		Indexes	Test results
Solid content(%)	not less than	50	68
Tensile strength (MPa) not less than	no treatment	1.0	2.2
	heat treatment	0.8	2.6
	alkali treatment	0.8	1.8
	UV treatment	0.8	1.7
	acid treatment	0.8	1.75
Heat resistance no flow, bubbling and sliding (°C)		>90	120
Elongation (%)	no treatment	≥100	195
	heat treatment	≥80	150
	alkali treatment	≥80	155
	acid treatment	≥80	140
	UV treatment	≥80	135
Low temperature flexibility (°C)		-20	-25
Waterproof	no leakage	0.3MPa, 30 min	0.3MPa, 30 min
Minimal film-forming temperature (°C)		0~5	-1~-2
Self-leveling property		self leveling of a film having a thickness of above 2 mm	Pass

3.2 Features

(1) No toxicity, no pollution, environment friendly

The coating includes water as medium, and is free of organic solvent, non-toxic and odorless. The use of this coating can save a large quantity of irreproducible sources, and effectively reduce environmental pollution. The process for the production of said coating discharges no waste (three wastes), and is reliable and safe.

(2) Good waterproof

The coating is characterized by high tensile strength, good elasticity, excellent heat resistance, good low temperature flexibility, excellent weather resistance, good resistance to acid, alkali, salt and chemicals, good cohesiveness, strong adaptability to deformation of substrate material, no ageing-fracture after long period of use, and good waterproof.

(3) Suitable for use at a low temperature of about 0°C

Since the components of the base material have a relatively lower T_g, being from -45°C to -70°C, the coating has a MFT of from -1 to -2°C, and thus is suitable for use at a low temperature of about 0°C.

(4) Self-leveling property

By using suitable modified rubber emulsion, auxiliaries and fillers, the coating is endowed with the property of self leveling. A uniform, continuous and flat coating film having a thickness of above 2.0 mm can be formed by once working. The working with the coating is highly efficient and convenient.

(5) Others.

The working with the coating can be carried out in a damp environment and on a damp basement layer, which is not affected by water content of the basement layer. The coating can be diluted with water to adjust the viscosity thereof. The working tools can be washed with water.

4. Application

In the first step, a basement layer is prepared. The basement layer is cleaned to remove ash and dirt on the surface. The surface of the basement layer shall be flat, clean, and no blow hole and pore. Beehive and surface pockmark on the basement layer shall be repaired with aqueous putty before working. The working is not affected by water content of the basement layer, but the site being in leakage shall be firstly treated to stop leaking.

The second step relates to mixing the materials. Firstly, liquid materials are homogeneously stirred with an electric agitator (200-300 r/min) for about 2-3 mins, to which powdery materials are gradually added in a ratio of 1-1.5:1, and

then the mixture is stirred for further about 10 mins.

Finally, the mixture is uniformly cast on the surface of the basement layer in an amount of $3-3.5 \text{ kg/m}^2$ (based on a dry film of 2 mm thick). Then, the film thus obtained is subjected to curing for 24-26 hours before putting into use.

The working conditions: environmental temperature is not less than 0°C , and relative humidity is not greater than 90%.

The green self-leveling elastic waterproofing coating is suitable for waterproof, dampproof, leakage-proof and leakage repair of roofing, outer wall, underground, bathroom and toilet room in house architectural construction, and is also appropriate for waterproof and dampproof of underground construction and facilities such as road, bridge, irrigation works and tunnels.